



**University of  
Zurich**<sup>UZH</sup>

**Zurich Open Repository and  
Archive**

University of Zurich  
University Library  
Strickhofstrasse 39  
CH-8057 Zurich  
[www.zora.uzh.ch](http://www.zora.uzh.ch)

---

Year: 2006

---

**Studies on a socio-ecological approach to environmental education – a  
contribution to a critical position in the education for sustainable  
development discourse**

Kyburz-Graber, R ; Hofer, K ; Wolfensberger, B

**Abstract:** This paper outlines a critical position in relation to education for sustainable development referring to a socio-ecological approach to environmental education. This approach was developed in a cooperative research process with pre-academic secondary schools over several years in Switzerland. For 13 years our research group has been the one in Switzerland to systematically research on curriculum and professional development in environmental education in secondary schools. The group was established at the Swiss Federal Institute of Technology in Zurich (ETHZ) supported by funding of the Swiss National Foundation for Scientific Research, and from 1998 proceeded with research projects at the Institute for Teacher Education (upper secondary level) at the University of Zurich. Case studies were carried out to explore the potentials and constraints which teachers and students meet when working with environmental issues. Two case studies from different research phases are shown which illustrate how both teachers and learners are challenged to cope with increasingly unstructured and unknown situations, pluralistic and controversial perspectives, and with the critical role of science in society. Outcomes are discussed in the light of the social process of sustainable development.

DOI: <https://doi.org/10.1080/13504620500527840>

Posted at the Zurich Open Repository and Archive, University of Zurich

ZORA URL: <https://doi.org/10.5167/uzh-47534>

Journal Article

Accepted Version

Originally published at:

Kyburz-Graber, R; Hofer, K; Wolfensberger, B (2006). Studies on a socio-ecological approach to environmental education – a contribution to a critical position in the education for sustainable development discourse. *Environmental Education Research*, 12(1):101-114.

DOI: <https://doi.org/10.1080/13504620500527840>

NOTICE: this is the authors' version of a work that was accepted for publication in Environmental Education Research (accepted author manuscript). Changes resulting from the publishing process, such as editing, corrections, structural formatting, and other quality control mechanisms may not be reflected in this document. For purposes of citation please refer to the printed version of this article.

## **Studies on a socio-ecological approach to environmental education – a contribution to a critical position in the sustainable development discourse**

REGULA KYBURZ-GRABER, KURT HOFER & BALZ WOLFENSBERGER,  
*University of Zurich*

### **Summary**

This paper outlines a critical position in relation to education for sustainable development referring to a socio-ecological approach to environmental education. This approach was developed in a cooperative research process with pre-academic secondary schools over several years in Switzerland. For 13 years our research group has been the one in Switzerland to systematically research on curriculum and professional development in environmental education in secondary schools. The group was established at the Swiss Federal Institute of Technology in Zurich (ETHZ) supported by funding of the Swiss National Foundation for Scientific Research, and from 1998 proceeded with research projects at the Institute for Teacher Education (upper secondary level) at the University of Zurich. Case studies were carried out to explore the potentials and constraints which teachers and students meet when working with environmental issues. Two case studies from different research phases are shown which illustrate how both teachers and learners are challenged to cope with increasingly unstructured and unknown situations, pluralistic and controversial perspectives, and with the critical role of science in society. Outcomes are discussed in the light of the social process of sustainable development.

### **Historical background of environmental education concepts**

In German-speaking countries and many others, environmental education discourses and programmes have been supplanted by 'education for sustainable development' ones. It has been argued that, in the light of sustainable development, environmental education was too much restricted to questions of ecology and the protection of nature, and that only education for sustainable development would be able to broaden the perspectives to include economic and social demands (see e.g. UNESCO, 2002, UNESCO, 2005; de Haan & Harenberg, 1999). In Germany, the competency to shape the future ('Gestaltungskompetenz') is named as a main goal of education for sustainable development (BLK, 1998).

The marginalisation of environmental education as well as its weakened position within the education for sustainable narrative has met with criticism (see e.g. Sauvé et al., 2003; Jickling and Wals, 2003; Lotz-Sisitka, 2004).

It (environmental education) is increasingly described as 'adjectival education'. Of concern is the fact that health promotion, rural transformation, human rights, sus-

tainable production and consumption, increased ICTs and other ‘framings’ (...), all have dimensions of ‘environmental sustainability’ and ‘environments’ associated with them. (Lotz-Sisitka, 2004, p.49)

Critical authors recall that there has been considerable research based on theoretical and practical developments in environmental education, embedded in a social science discourse, and important developments continue. Those processes have opened up socially critical alternatives in environmental thinking which might now be compromised by UNESCO’s framing of education for sustainable development (UNESCO, 2002, 2005).

In Switzerland, environmental education and education for sustainable development are, to a certain extent, co-existing pedagogical positions. Recently, an initiative of the Swiss Foundation for Environmental Education resulted in an action programme which left open the question of whether environmental education ought to be replaced by education for sustainable development, or vice versa (EDK, 2002). In this document, it is stated that

environmental education has to be re-oriented within the social process of sustainable development and the educational policy context and has to take into account new knowledge from environmental and educational research (EDK, 2002, p.15, translated).

Environmental education and education for sustainable development are both seen as responses to educational demands concerning the priority of ‘sustainability’, a position which is stated in a national educational policy document (EDK 2003, action plan for 2004).

The historical background of environmental education as a pedagogical movement for the protection of nature which emerged in the early 20<sup>th</sup> century (Kyburz-Graber et al., 2001) led to its having a strong missionary focus which provoked resistance from those who defended an emancipatory approach to education (Kyburz-Graber, 2004a). This observation may be generally true for German speaking countries where, more than in many other countries – as far as we have experienced in international environmental education contexts – environmental education has maintained its focus as an educational task with a highly moral and pedagogically normative bias.

In Switzerland however, with the environmental sciences research programme of the Swiss National Foundation for Scientific Research in 1992-2002, the scientific environmental discourse changed significantly (Häberli et al., 2002). It emerged that it was mainly those research questions raised and researched in interdisciplinary teams by the social sciences (including economics) and the humanities, which led to effective shifts in thinking and acting.

Within this interdisciplinary research context, our research group embarked upon a long-term research project on environmental education in which we decided not to follow the German tradition of surveying environmental education practice in general (see Eulefeld et al., 1993). The studies conducted by Eulefeld and his collaborators were based on the assumption that a direct relationship between pedagogical arrangements (e.g. a problem-based approach) and environmental action competencies can be proved by empirical data (see Kyburz-Graber, 2004a). We were – and still are – sceptical if any evidence for ‘best’ educational approaches considering the multiple and changing variables in this field can be found. We regard environmental education pedagogy as highly contextual, depending on teachers’ and students’ previous experiences, on their local environments, school culture,

and societal developments. Thus, we are more interested in getting in depth views of how environmental learning situations develop in this context, how teachers and learners reflect about environmental issues, and what matters to them.

Since 1992 we have, through case study research, been exploring a socio-ecological approach to environmental education (Kyburz-Graber, 2004a, b; Kyburz-Graber et al., 1997a, b) which follows critical perspectives on environmental issues and an emancipatory position within educational philosophies. The case studies were designed and research questions built on the outcomes of previous cases. We started with the research question of how a socio-ecological approach was conceptualised within school practice, moving on to the difficulties teachers meet while working in open-ended teaching-learning processes on socio-ecological issues with no pre-existing knowledge basis. This led to the question of whether schools, which practice project learning, are able to orient their work towards problem-based learning, and the construction of meaningful knowledge, and questions about the participation of students. Further, it was inquired under which conditions this might happen. Classroom discussions on complex issues revealed themselves as crucial learning situations in open, participatory teaching-learning processes, which led to a research question focusing on how such discussions are conducted. Video-based studies of reflective classroom discussions led to pre-service and in-service training material. Outcomes of our research studies influenced national reports and contributed to international publications within the ENSI programme 'Environment and School Initiatives' (OECD-CERI, 1995), as well as to national strategic policy publications (EDK, 2002).

### **The socio-ecological approach to environmental education**

Education has traditionally been assigned the role of transmitting existing knowledge that is widely approved and accepted by society. With increasing pluralism, contradictory interpretations of research findings and growing complexity in searching for democratic solutions, educational systems are now being challenged to re-orient their educational practice in the light of the ultimate goal: supporting young people to develop their fullest potential for being active and self-responsible individuals accepting their roles as global citizens. In this light, education can neither take a closed position within society which is restricted to a screened world of its own, nor can it take a position which is uncritically open to all trends and developments in modern society. We argue for a position in-between, which implies that education generally has to promote young peoples' competencies for critically analysing and reflecting on situations, living conditions and values; and for developing a multi-perspective understanding of the complexity of these issues.

It has been a traditional view of environmental problems that people should learn what causes those problems, and how to avoid them. With increased interdisciplinary knowledge and experience of environmental issues, however, it has become clear that the interpretation of what is meant by the term "environmental issue" is not a trivial matter: it is not merely the observed facts, but includes the content of the interpretations of the facts, the attribution of causes, and the search for solutions (Hirsch, 1995).

In this wider perspective, an environmental impact may be interpreted not only as the effect of inappropriate behaviour, but also as the unexpected side-effect of human activities. What people do or do not do is usually not decided according to environmental principles, but according to events in their private, professional and public lives. People usually make decisions in their daily lives based on their need, or desire, to be successful and fulfilled, e.g. to drive to work, to produce goods, to go shopping or to enjoy their leisure time. It is not their intention to harm the environment. The extent to which the environment is

harmful by those activities – and if so, how – is dependent on subjective judgments and is supported or opposed by social groups, political strategies and media reports. Whether and to what extent an airport is contributing to climate change is not merely a question of measuring carbon dioxide emissions, but is also a question of judging these measurements within a socio-ecological context. Environmental issues, we thus conclude, are only partly questions of scientific evidence, but are also questions of interests, needs, values, interpretations, conditions and social contexts.

Thus, the challenge for environmental education is to provide learning situations in which learners have the opportunity to explore, analyse and interpret human actions in real-life situations and to search for solutions with the participation of the people concerned. Meaningful starting points for socio-ecological environmental education are, therefore, not environmental impacts and general environmental topics like energy, water and air, but real-life situations (socio-economic contexts) in which people are involved in their daily lives: family households, communities, businesses, schools, supermarkets, restaurants, recreation areas, sports grounds etc. Environmental issues are treated as social-contextual constructions of the people involved. When learners interact with those constructions, they can generate local and socially relevant knowledge; they can reflect on values and value systems, explore conditions of action, and work on possibilities for individual and structural change. To put the socio-ecological approach in a nutshell: it is situation- and issue-oriented, it includes the experiences and perspectives of the people involved, and findings are developed in a cooperative, interactive way.

### **Two case studies on socio-ecological environmental education**

A first series of case studies was launched in cooperation with interdisciplinary teacher teams with the aim of developing an approach to environmental education which invites students to explore and critically reflect on local everyday situations. The outcome of this research phase was developed as the socio-ecological approach. With a second series of case studies, we analysed existing projects in schools, and in a third phase we are currently studying interdisciplinary classroom discussions on socio-ecological issues which we identified as key learning situations in socio-ecological environmental education. We now present two case studies, one each from the first and third phases.

#### **A case study on a socio-ecological curriculum development project in a secondary school, pre-academic level**

The project ‘Recreation Area by Lake Constance’ (which lies between Switzerland, Germany and Austria) was developed by a teacher team in an upper secondary school with 11<sup>th</sup> and 12<sup>th</sup>-grade students in the north-east of Switzerland (Kyburz-Graber et al., 1997a, b). The school is located close to the shore of Lake Constance, in an area where leisure activities and nature protection concerns interact. Seven teachers of biology, German language, psychology, geography and art were involved, together with three classes. In a collaborative process, we developed a participatory research approach. As a research team, we negotiated our role as initiators of the school projects following the reasoning of the socio-ecological approach, offering forums for reflection and discussion (eight seminars at the school), collecting and analysing data provided by the teachers (planning documents and project products, workshop protocols, discussion documents, interviews, and feedback from the students).

The case study focused on two questions:

- (1) What aspects are relevant in local curriculum development using a socio-ecological approach to environmental issues?
- (2) What difficulties and obstacles emerge while working on environmental issues in school?

Using a combination of summarising and structuring content analysis (Mayring, 2000), we analysed how teachers and students explored

- *social relations* between the social system (recreation area) and the social environment,
- *ecological relations* between the social system and the natural environment,
- *interdependences between society and nature*,
- *historical relations*,
- *assumptions about causes of and reasons for* observed actions and environmental impacts,
- *judgments* of observed and assumed effects, side effects and feedback reactions,
- *normative aspects* concerning individual and collective value systems, beliefs and conflicts.

Although a broad range of aspects and possible approaches were discussed in the planning phase, one of the projects was started by the biology teacher with a biological excursion of the kind he is used to carrying out. His aim was to let the students observe and get to know plants, plant societies, birds, reptiles, amphibians and insects, while including further socio-ecological aspects later. The German teacher chose ‘changing perspectives’ as a topic, asking the students to conduct interviews and construct texts on the topic. In addition, she read a text by Dörner about dealing with complex problems (Dörner, 1993). The psychology teacher worked on subjective theories with the students, analysing their personal recreational activities on the shore of Lake Constance. Finally, the psychology teacher organised a simulation activity on problem solving based on the text by Dörner which had been read with the German teacher. The simulation activity involved three communities which invited their citizens to decide on a new concept for land management in which human needs were to be prioritised over nature protection goals. Working in mixed groups with various (simulated) interests, the students began by forming lobby groups, then developed utilisation concepts and finally tried to integrate them into a common solution.

With a parallel class, another biology teacher and a geography teacher decided to start with students’ own questions concerning the use of the shore area. They only chose this approach when a traditional start-up with questions previously defined by the teachers failed to stimulate interest. The students asked for a discussion together with the research team in which they formulated their own ideas: Are recreational facilities necessary? What are people’s motives in coming to the lakeside area? Why should nature not be left as it is? Why are some people interested in nature whereas others are not? Was the situation different in former times, and was it better? The students explored a limited area of the shore in detail and drew maps according to their findings. The teachers helped them to develop research questions and questionnaires to analyse and design aspects such as ‘the picturesque character of Lake Constance’, young people and the lake, environmental changes involving the lake between 1934 and 1994, the commercialisation of the lake, and utilisation for leisure. The biology and geography teachers’ original idea of working closely with subject-related issues and methods was gradually supplanted by the students’ ultimate wish to explore their own questions. At the beginning, the biology teacher in particular was highly

sceptical about this opening-up into a students' project, but finally felt pleased with the students' findings and their satisfaction concerning the project process and their learning. The students involved appreciated the project much more than their parallel class, who felt that they received too much guidance and were thus restricted in their work.

In the final seminar, the project was evaluated in the light of the goals achieved. One of the biology teachers wanted to know from the students whether they had changed their attitudes and behaviour. He seemed to be keen to see success in their project, which he associated with changed behaviour. The students could not point to any specific changes in their behaviour, and, one of the students described his feelings as follows:

My behaviour certainly has not changed. I am interested in the question: What did I learn? I worked with the topic 'The picturesque character of the lake' and learnt that there are two dimensions to environmental issues. The first is activity, enjoyment, recreation, strolling. The second is noticing that there are problems and that the environment is not OK. It was an important experience, both in the interviews and in taking pictures, to realise that these dimensions do not touch each other in human activity today. This means that action and awareness have to be linked (student, cited in Kyburz-Graber 1997a, p.242).

Looking across the school projects, it emerged that the main difficulties and obstacles for teachers and students were:

- dealing with tensions,
- thinking in relational dimensions,
- including reflections on values and learning processes,
- developing a participatory teaching and learning model in all phases of class projects.

With the socio-ecological approach teachers and students recognised the social dimensions in their local environment. Taking a social system as focus for their investigations, they asked questions beyond natural science touching ethical, political, economic and sociological issues which opened up a critical view on environmental issues. Students seemed to feel more open about asking for those dimensions to environmental issues than their teachers who tended to want to hold to well established teaching practices.

The question of changing behaviour – a prevailing concern among teachers – loses its relevance when teachers and students are working on socio-ecological issues. Rather, it is the process of reflection on the interaction between nature and society which has emerged as a key element in this form of environmental education and which aims at understanding the complexity of real-life situations. Reflection seems indispensable when students are learning from environmental issues. However, as the case studies revealed, reflection needs much more professional attention than was expected before.

#### **A case study on classroom discussions on socio-ecological issues in a secondary school, pre-academic level**

In order to achieve a better understanding of how teachers and students reflect on socio-ecological questions and how they clarify validity claims, we invited biology and history/philosophy teachers to develop a curriculum project in tandem groups and to work with their students on socio-ecological topics situated at the interface between natural sciences, technology and society, dealing with perspectives, value judgments and interests, as well as with uncertain knowledge. The benefit for the teachers was to participate in an interdisciplinary project with in-service training workshops. In order to build on a reliable basis for all partners, we asked the school leaders to work out contracts with the teachers in which it was negotiated which prerequisites (time, extra payment etc.) the teachers were

offered as collaborators in the project. The prerequisites depended on the specific context of the school and its curriculum. It was agreed with the teachers that they would be free to organise the pedagogical work with their students, except that they should include three classroom discussions, at the beginning, in the middle and at the end of the project. All of the teachers involved agreed to arrange their class projects within a core topic which was found in the first workshop: “A Garden of Eden from a human hand?” This core topic allowed participants to focus on the interface between nature and society, and to include questions of natural sciences and philosophy within a socio-ecological approach.

In accordance with the reasoning presented by Mortimer & Scott (2000), Roth & Lucas (1997), and Wals (1997), we assumed that, in order to achieve their fullest potential, reflective discussions needed a special pedagogical setting which cannot be achieved either by learning in small groups or by learning in the instructional mode of class teaching. Reflective classroom discussions seem to require special arrangements which allowed students to critically reflect upon and react to other peoples’ arguments and to become aware of pitfalls in their own reasoning and pre-judgments.

Data on the reflective classroom discussions were collected by making video recordings of the entire discussions with two cameras. The video documents were then transcribed and analysed in three steps: (1) descriptive statistics of the interaction between the participants; (2) analysis of the discussions on a macro level; and (3) bottom-up interpretative content analysis of the class discussion transcripts, asking questions about ‘what’ and ‘how’ the subject-matter was discussed and looking for explanations as to ‘why’ it was discussed in the way it was. In order to answer the question of ‘what’, the topic covered within the discourse were reconstructed and reproduced in a kind of ‘topic chart’ by rearranging repeated issues into main foci. Patterns, concepts, knowledge stocks and key terms were identified and reconstructed by answering the question of ‘how’ within the main topics argumentations. The reconstructed class discussions were interpreted from a pedagogical-didactic perspective in answering the question of ‘why’ (see Wolfensberger & Kyburz-Graber, 2005; Wolfensberger et al., 2005; Kyburz-Graber et al., 2004).

In a first workshop with the teachers, the significance of the socio-ecological approach and concepts of critical thinking were discussed. In the case described here, the two teachers of a 12<sup>th</sup>-grade pre-academic class chose the topic ‘potential benefits and risks of new biotechnologies.’ In the initial phase, the 25 students worked in two groups. The biology group learned basic facts about ‘green’ technology, cloning and stem cell research, while the philosophy group learned about ethical principles like the principles of discourse, justice, instrumentalisation and utility. In subsequent phases, the students exchanged their knowledge in mixed ‘puzzle’ groups and worked out pros and cons of gene technology, cloning and stem cell research. Resultant position papers were used as an introduction to class discussions, which were arranged as a kind of adversarial platform debate.

Statistical analysis of the class discussions shows lively participation by the students (53%, 73% and 76% of the statements are given by students in the three class discussions respectively), which by far exceeds the usual pattern of classroom teaching. The bottom-up content analysis of the discussions reveals some striking findings: there seems to be a ‘division of labour’ between natural science on the one hand and social science/philosophy on the other. In the students’ view, philosophy aims to enlighten social problems and to judge scientific-technical knowledge. Ethical principles which had been worked out in the preparatory sessions were somehow used by the students as reliable knowledge and methodological instruments. Natural sciences, in the students’ eyes, seem to provide real scientific



knowledge. Even if they are judged by ethical categories, they seem – in the view of the students – to form the final basis of decision for the handling of biotechnologies in society. The students expect natural sciences to offer solutions for a number of problems, e.g. social problems. The uncertainty of knowledge is recognised, but a majority of statements indicate that students expect ongoing research efforts to reduce or even eliminate uncertainties. The unquestioned right of science to search out progress is taken for granted:

We want to have progress in research, we want to remain on the top, we want to invest money in our education, that is, ... you can't change it. (student 2, male, first discussion, turn 94, translated)

It is not a matter of commercialisation and making money. It is, for me in any case, a matter mainly of research. That we make progress, that ill persons can be helped, and that by this, we can have success. (student 10, male, first discussion, turn 115, translated)

Another striking outcome concerns the ambivalence of the researcher's image: throughout the discussions, the researcher is referred to as a natural science researcher and a male researcher. He is typically seen as a man who has an untamed urge to generate knowledge, and his overriding interest is progress. Everything that is important to 'normal' people, such as social relations or attachment to a domicile, takes second place to this overriding preoccupation. Yet, this image is not negatively connoted, since researchers are seen as those who are able to take appropriate decisions in the Swiss democratic system (which is, in part, a direct democracy) because of their unprejudiced, 'true' knowledge.

Yes, I think ..., if they get missed out or not, the people, I think ... well here it need not be the question because I think, research, the people who do research and the politicians, they probably deal intensively with this topic, and I think, perhaps they know ... perhaps even better ... what it is all about and what the dangers are and they perhaps have also less prejudices and are therefore able to make better decisions. (student 7, female, first discussion, turn 179, translated)

On the other hand, some students also voiced doubts and criticism of uncontrolled research activities.

Yes, I think for ... normal citizens like we are, we could say: yes, animals may be cloned, humans not ... there is a clear limit. But I have no confidence in research any more, that it has ... the tendency to simply try things. And ... the temptation is probably huge for a researcher that he one day is saying, once is saying: Hey, why shouldn't I try for once, it is going so well. And that in this case, the danger is simply too high. (student 23, female, second discussion, turn 421)

A third outcome concerns the way students use their knowledge basis. What they worked on throughout the first phase is not further developed in class discussions. Several times, the biology teacher is referred to as the one who can provide the 'right' scientific answer: the students themselves do not search for arguments or additional reasoning. Reasoning about assumptions and claims, as well as critical judgment of statements, does not occur. The discussions appear, over long phases, to involve more a lining up of single positions than a multi-perspective interaction on the causes, conditions and effects of human think-

ing and actions. Normative aspects, value judgments and interests are mentioned but not further questioned, and thus remain implicit and unreflected.

The students' discussions seem to mirror the current social debate without seizing the opportunity for deeper considerations in an educational context. This outcome may be due to the teachers' attempt to establish a lively discussion as a priority, no matter what knowledge is generated beyond what the students themselves have worked out. Thus, the true potential of a reflective classroom discussion in a socio-ecological context is not realised either by the teachers or by the students.

### **The socio-ecological approach: a critical perspective on education for sustainable development**

The two cases described in this paper illustrate some key features that teachers and students are explicitly or implicitly dealing with when they explore environmental issues. These issues are not defined *per se*, but need ongoing reflection and debate about

- anthropogenically-induced causes of environmental degradation,
- the interpretation of environmental issues depending on subjective awareness,
- the beliefs and norms of the people (and experts) involved,
- the socially-set conditions of individual and collective human action which has impacts on the environment and on living conditions,
- the socially-attributed role of scientists in society,
- questions about what is accepted as 'truth' and trustworthy knowledge,
- the role of individuals and social groups for processes of social change,
- agenda-setting and the representation of critical views and debates in the mass media.

The rhetoric of sustainable development sometimes seems to conceal these aspects by emphasizing a balance between the social, economic and ecological dimensions of the problem. The metaphor of such a balance evokes a picture of harmony, equality and justice. In reality, in the light of sustainable development, issues of environmental stress do not do us the favour of being resolvable by just balancing the social, economic and ecological dimensions of the problem. In fact, what appears as those dimensions is dependent on the – often controversial – perspectives of individuals and social groups. And what evolves as a 'solution' is mostly the expression of which groups have the most powerful influence on those who decide; also in a democratic system like Switzerland where every citizen aged over 18 years has the right to vote about changes of the federal constitution, laws (e.g. the environmental protection law, laws for education), the construction of roads and highways, financing public traffic, and has the right to vote at local levels in small and middle sized communities without parliaments on the budget, school development projects, local initiatives for the conservation of biodiversity etc. In this system developments strongly depend on the powerful lobbying and representation of those social groups which defend their interests with money and influence. At the same time this partly direct democratic system offers a great variety of opportunities for participation and a steadily critical debate while giving voice to all kinds of perspectives.

Environmental education has the potential to contribute to this critical debate through a form of education which is an integral element of society and which is linked to it by means of feedback and exchange. Environmental education, throughout its comparatively short research-based history, has developed the potential for socially-critical approaches (Robottom, 2003; Sauvé et al., 2003). We claim that this socio-ecological approach has

integrated the view of socially constructed environmental issues into teachers' practical work. Education for sustainable development is sometimes seen to omit or forget this critical perspective.

### **Conclusions: key issues in the education for sustainable development discourse that matter to teachers and learners**

We worked with a case study methodology because we wanted to explore the multiple dimensions and crucial aspects of local environmental learning situations in relation to teacher and learner background and specific school contexts. The participatory research methodology provided an in-depth view of significant challenges teachers and students are struggling with when working in environmental education. The research has contributed to theoretical developments using a replication logic of generalisation instead of statistical logic (see Kyburz-Graber, 2004b) which is still widely assumed by some to be the most trustworthy basis for constructing theories. Our research was strongly influenced by the 'Environment and School Initiatives' project (ENSI), and was designed to develop a stronger theoretical basis with regard to the nature of environmental problems and pedagogical concepts of environmental education, as well as the methodology of case study research (Kyburz-Graber, 2004b).

Occasionally, critics observe that both teachers and students are overstretched by the demands of a critical environmental education. Our response is that changes in our global world imply educational settings in which students and teachers learn to interact with complex issues. School tends to reduce real-life issues to structured topics, to simplify things and to exclude controversial knowledge and confrontation with social and political conflicts. Environmental issues seen in a socio-ecological light do not do us the favour of being disciplinary, well-structured and easily accessible (Mittelstrass, 1995, cited in Kyburz-Graber, 2003).

The case studies we worked with in various schools revealed that teachers and students adopt a critical perspective if they work on local environmental issues which include the question of what sort of future they associate with the situation analysed. They start to reflect on interests, beliefs, values, and the basis of knowledge and power. Key issues in such teaching-learning processes seem to be: the construction and critical use of knowledge; the critical analysis of the role of natural science; the interface between natural science and social science and the humanities; and the appropriate pedagogical settings for in-depth discussion and reflection. Developments in our society favour action, facts, visible effects, measurable standards associated with progress. Learning with environmental issues, by contrast, requires thoughtfulness and reflection.

### **Acknowledgments**

We are grateful to the Swiss National Foundation (SNF) for financial support of various research projects since 1992. This paper is partly based on the National Foundation Project „*Naturwissenschaften im sozialen Kontext: Eine Untersuchung zur Re-Orientierung des naturwissenschaftlichen Unterrichts an Gymnasien am Beispiel des Biologieunterrichts*“ (2001-2004) at the University of Zurich. Particularly, we cordially thank the teachers who collaborated in the research projects. We would also like to thank Sibylle Locher for valuable comments on drafts of this paper and Andrew Torr for his editorial work.

### **Notes on contributors**

REGULA KYBURZ-GRABER is a Professor at the Institute for Teacher Education, University of Zurich. She studied biology and got her Ph.D. in biology and didactics at the Swiss Federal Institute of Technology in Zurich. Her fields of research include science curriculum development, environmental education, case study methodology, interdisciplinary teaching and learning, self evaluation, and the professional development of teachers. *Correspondence:* Universität Zürich, Höheres Lehramt Mittelschulen, Beckenhofstrasse 35, CH-8006 Zürich, Switzerland. E-mail: kyburz@hlm.unizh.ch

KURT HOFER did his Ph.D. in the Swiss Priority Program Environment (Integriertes Projekt Ernährung) within an interdisciplinary research project on nutrition sociology. He is a Senior assistant at the Institute for Teacher Education (Höheres Lehramt Mittelschulen), University of Zurich and is currently leading the Project “ReflecT” (2004-2007) investigating the potential of the reflective teaching approach in science education. Both projects were funded by the Swiss National Science Foundation.

BALZ WOLFENBERGER has been a research scientist and Ph.D. student at the Institute for Teacher Education (Höheres Lehramt Mittelschulen), University of Zurich since 2002. He also works as a history teacher in upper secondary schools. His main professional interests are qualitative social and educational research, classroom discussions, critical educational science, history and philosophy of science, contemporary history and interdisciplinarity.

## References

- BLK, Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung (1998) *Bildung für eine Nachhaltige Entwicklung. Orientierungsrahmen*. Bonn: BLK.
- Dörner, D. (1993) Denken und Handeln in Unbestimmtheit und Komplexität, *GAIA*, 2 (3), 128-138.
- EDK, Schweizerische Konferenz der kantonalen Erziehungsdirektoren (2003) *Fortschreibung 2003 des Tätigkeitsprogramms der EDK ab 2001 nach Arbeitsschwerpunkten*. Available at: [http://www.edk.ch/PDF\\_Downloads/LLTG/TGP\\_d.pdf](http://www.edk.ch/PDF_Downloads/LLTG/TGP_d.pdf), accessed November 07, 2005.
- EDK, Schweizerische Konferenz der kantonalen Erziehungsdirektoren (ed.) (2002) *Beitrag der Umweltbildung an eine nachhaltige Entwicklung*. Studien und Bericht 15A der Projektgruppe Zukunft Umwelt Bildung Schweiz. Bern: Stiftung Umweltbildung Schweiz.
- Eulefeld, G., Bolscho, D., Rode, H., Rost, J. & Seybold, H. (1993) *Entwicklung der Praxis schulischer Umwelterziehung in Deutschland*. Kiel: IPN.
- Haan, de G. & Harenberg, D. (1999) *Bildung für eine nachhaltige Entwicklung, Materialien zur Bildungsplanung und Forschungsförderung*, (Bonn, BLK), Heft 72.
- Häberli, R., Gasser, R., Grossenbacher-Mansuy, W. & Lehmann Pollheimer, D. (2002) *Vision Lebensqualität: Nachhaltige Entwicklung – Ökologische notwendig, wirtschaftliche klug, gesellschaftlich möglich*. Schlussbericht Schwerpunktprogramm Umwelt. Zürich: vdf Hochschulverlag.
- Hirsch, G. (1995) Beziehungen zwischen Umweltforschung und disziplinärer Forschung. *GAIA*, 4 (5-6), 302-314.

- Jickling, B. & Wals, A. (2003) Environmental Education in Transition: Looking Beyond Sustainability and Sustainable Development. Paper presented at the First World Environmental Education Congress, Espinho, Portugal, May 20-24, 2003.
- Kyburz-Graber, R., Wolfensberger, B., Hofer, K., Pangrazzi, R., Dübendorfer, A., Canella, C. & Peter, U. (2004) *Naturwissenschaften im sozialen Kontext: Eine Untersuchung zur Re-Orientierung des naturwissenschaftlichen Unterrichts an Gymnasien am Beispiel des Biologieunterrichts*. Wissenschaftlicher Schlussbericht zum Nationalfondprojekt 1114-065117.01. Zürich: Institute for Teacher Education, University of Zürich.
- Kyburz-Graber, R. (2004a) Welches Wissen, welche Bildung? Aktuelle Entwicklungen in der Umweltbildung, *Beiträge zur Lehrerbildung*, 22 (1), 83-94.
- Kyburz-Graber, R. (2004b) Does case-study methodology lack rigour?: The need for quality criteria for sound case-study research, as illustrated by a recent case in secondary and higher education, *Environmental Education Research*, 10 (1), 53-65.
- Kyburz-Graber, R. (2003) Interdisciplinarity and environmental education – two demands in teacher education. In: R. Kyburz-Graber, P. Posch & Peter, U. (eds.) *Challenges in Teacher Education: Interdisciplinarity and Environmental Education*. Innsbruck: Studien Verlag. 12-23.
- Kyburz-Graber, Regula, Halder, U., Hügli, A. & Ritter, M. (2001) *Umweltbildung im 20. Jahrhundert: Anfänge, Gegenwartsprobleme, Perspektiven*. München/Berlin: Waxmann.
- Kyburz-Graber, R., Rigendinger, L., Hirsch Hadorn, G. & Werner Zentner, K. (1997a) *Sozio-ökologische Umweltbildung*. Hamburg: Krämer.
- Kyburz-Graber, R., Rigendinger, L., Hirsch Hadorn, G. & Werner Zentner, K. (1997b) A socio-ecological approach to interdisciplinary environmental education in senior high schools, *Environmental Education Research*, 3(1), 17-28.
- Lotz-Sisitka, H. (2004) *Positioning southern African environmental education in a changing context*. Howick: Share-Net/SADC REEP.
- Mayring, Ph. (2000) *Qualitative Inhaltsanalyse. Grundlagen und Techniken*. Weinheim: Beltz.
- Mortimer, E. & Scott, P. (2000) Analysing discourse in the classroom. In: J. Osborne (ed.). *Improving Science Education: the Contribution of Research*. Buckingham/ Philadelphia: Open University Press. 126-142.
- OECD-CERI (1995) *Environmental Learning for the 21<sup>st</sup> Century*. Paris: OECD.
- Robottom, I. (2003) Shifts in Understanding Environmental Education. In: R. Kyburz-Graber, P. Posch & Peter, U. (eds.) *Challenges in Teacher Education: Interdisciplinarity and Environmental Education*. Innsbruck: Studien Verlag. 34-40.
- Roth, W.-M. & Lucas, K.B. (1997) From 'truth' to 'invented reality:' A discourse analysis of high school physics students' talk about scientific knowledge, *Journal of Research in Science Teaching*, 34 (2), 145-179.
- Sauvé, L., Berryman, T. & Brunelle, R. (2003) Environnement et développement: la culture de la filière ONU, *Education relative à l'environnement, Regards, Recherches, Réflexions*, 4, 33-55.
- UNESCO (2002) *Education for Sustainability. From Rio to Johannesburg: Lessons learnt from a decade of commitment*. Paris: UNESCO.
- UNESCO (2005) *United Nations Decade of Education for Sustainable Development 2005-2014. Draft International Implementation Scheme*. Paris: UNESCO.
- Wals, A. (1997) Alternatives to national standards for environmental education: process-based quality assessment, *Canadian Journal of Environmental Education*, 2, 7-27.
- Wolfensberger, B. & Kyburz-Graber, R. (2005) Klassengespräche zu sozio-ökologischen Themen an der Schnittstelle zwischen Naturwissenschaften und Gesellschaft – Eine

- Videoanalyse. In: M. Schrenk & W. Holl-Giese (eds.). *Bildung für nachhaltige Entwicklung: Ergebnisse empirischer Untersuchungen*. Band 1. Hamburg: Verlag Dr. Kovač. 113-129.
- Wolfensberger, B., Hofer, K. & Kyburz-Graber, R. (2005, in press) Schülerinnen und Schüler debattieren über Biotechnologien – Eine Fallanalyse von Klassengesprächen über ein Thema im Schnittbereich von Naturwissenschaften und Gesellschaft. In: W. Riess & H. Apel (eds.). *Bildung für eine nachhaltige Entwicklung – aktuelle Forschungsfelder und -ansätze*. Wiesbaden: VS Verlag für Sozialwissenschaften.